

REMARKS

A. Request for Reconsideration

Applicant has carefully considered the matters raised by the Examiner in the outstanding Office Action but remains of the position that patentable subject matter is present. Applicant respectfully requests reconsideration of the Examiner's position based on the amendments to the claims and the following remarks.

B. Claim Status and Amendments

Claims 1-8 are presented for further prosecution.

Claims 1, 4 and 7-8 have been amended herein to clear the formality deficiencies.

Claims 4-8 have also been amended to change the term "composition" back to "compound" to clarify the steps the process.

No new matter was added.

C. The Invention

The present invention relates to an elastomeric compound having a high filler content of 15% to 500% by weight of the compound, which additionally contains 1 to

400% by weight of the compound of microsilica as a modifier to improve the processability.

As defined in the specification, the term microsilica used in the specification and claims is particulate amorphous SiO_2 obtained from a process in which silica is reduced to SiO -gas and the reduction product is oxidized in vapor phase to form amorphous silica. Microsilica may contain at least 70% by weight silica (SiO_2) and has a specific density of 2.1 - 2.3 g/cm^3 and a surface area of 15 - 50 mg^2/g . The primary particles are substantially spherical and have an average size of about 0.15 μm .

D. The Office Action

In the Office Action the Examiner made several formal rejections and prior art rejections.

a) Formal Rejections

1. Claim Objections

Claim 1 and 4 are objected for redundant words "a filler".

Applicant has deleted the redundant phrase "having a filler content".

2. Claim Rejections under 35 USC § 112

Claims 1, 4, 7 and 8 had been rejected under 35 U.S.C. 112 as being non-compliance with the written description requirement for the missing word "about".

Applicant has amended claims 1, 4, 7 and 8 to include the word "about" in front of the two percentages of the filler.

3. Double Patenting Rejections

Claims 1-8 had been rejected as being obvious in view of the copending Application No. 11/718590.

This is an obviousness-type double patenting rejection. The present application was filed on March 8, 2006, which is before the filing date of the cited application 11/718,590 filed on May 3, 2007. Therefore, the Double Patenting rejections should be held in abeyance until this case is ready for allowance.

b) Prior Art Rejections

1. Claim Rejections - 35 USC § 102

Claims 1-3 had been rejected under 35 U.S.C. 102(b) as being anticipated by Mitsuhashi.

Mitsuhashi teaches a fir-retardant silicone rubber composition with 10-100 parts by weight silica powder, selected from mist silica, hydrophobic silica, set process

silica and the end of quartz powder. The examiner takes the position that mist silica is silica fume and silica fume is microsilica. Applicant respectfully disagrees.

As defined in the specification:

"The term microsilica used in the specification and claims of this application is particulate amorphous SiO_2 obtained from a process in which silica (quartz) is reduced to SiO -gas and the reduction product is oxidised in vapour phase to form amorphous silica. Microsilica may contain at least 70% by weight silica (SiO_2) and has a specific density of 2.1 - 2.3 g/cm^3 and a surface area of 15 - 50 mg^2/g . The primary particles are substantially spherical and have an average size of about 0.15 μm ."

There is no teaching of such a microsilica in Misuhashi. Misuhashi only discloses the silica powders having a size less than 50 μm are preferred. Comparing with the preferred size of the microsilica in the present application, Misuhashi's silica powder is 330 times bigger.

The silica powders numerated in Misuhashi are mist silica/fumed silica, hydrophobic silica, wet process silica, and quartz powder. No microsilica is mentioned. The position that mist silica is silica fume and silica fume is microsilica, has no support from Misuhashi or other literature.

It is respectfully submitted that, since Misuhashi does not disclose the microsilica element of the rejected

claims with sufficient clarity as required by 35 U.S.C. § 102, Rejections to the claims 1-3 should be withdrawn.

2. Claim Rejection under 35 USC § 103

Claims 4-8 had been rejected under 35 U.S.C. 103(a) as being unpatentable over Mitsuhashi. The examiner takes the position that the additional step of adding microsilica to the highly filled elastomeric compound is obvious.

Applicant has amended claims 3-8 to recite the "high filled elastomeric compound" previously claimed, in order to emphasize that the elastomeric compound with highly filled content has been formed prior to the addition of microsilica.

Since the machine translation of Mitsuhashi is not comprehensible, Applicant provides a full translation of the patent document for the Examiner's reference. It is shown in Mitsuhashi paragraph [0012], that the silicon rubber was formed by one step of furnace heating of all the compositions, without performing any highly filled elastomeric compound first.

Although the Examiner may infer from Mitsuhashi that the content of microsilica, as one of the ingredient of the total composition, can be added to the "mixture" of other composition, however, Mitsuhashi does not suggest or imply

a step of forming a highly filled elastomeric compound first and then adding microsilica to modify its processability.

Therefore, it is respectfully submitted that Mitsuhashi does not render the present invention as in Claims 4-8 obvious and unpatentable.

E. Conclusion

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance and such action is respectfully requested. Should any extensions of time or fees be necessary in order to maintain this Application in pending condition, appropriate requests are hereby made and authorization is given to debit account #02-2275.

Respectfully submitted,

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Enclosure: English translation of Mitsuhashi, et al.

Japanese Patent Kokai No. 09-12888

Laid-opening date: 14 January 1997

Application No.: 07-165495

Filing date: 30 June 1995

Applicant: Shinetsu Polymer Co., Ltd., Tokyo

Title: Refractory fire-retardant silicone rubber composition

Claim (single):

A refractory fire-retardant silicone rubber composition which comprises:

- | | | |
|-----|--|------------------------|
| (a) | organopolysiloxane shown with the average unit formula $\text{SiO}(4-a)_2$ (wherein R is an unsubstituted or substituted monovalent hydrocarbon radical of same kind or different kind, and \bar{a} is mean number of 1.9-2.1) | 100 parts by weight |
| (b) | silica powder | 10-100 parts by weight |
| (c) | mica | 50-100 parts by weight |
| (d) | crystallite | 10-50 parts by weight |
| (e) | aluminium hydroxide | 1-80 parts by weight |
| (f) | magnesium hydroxide | 6-80 parts by weight |
| (g) | platinum or platinum compound containing platinum of same quantity relative to (a) in terms of platinum | 5-500ppm |

and in which aluminium hydroxide/magnesium is of the ratio 1/9 to 4/6, and the total quantity thereof is 10 to 80 parts by weight.

[Detailed Description of the Invention]

[0001]

[Industrial Field of the Invention]

The present invention relates to a refractory fire-retardant

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silicone rubber composition which if sintered at an elevated temperature it ceramicizes so as to remain in joint parts and glass fitting-in grooves, and which is used, being foamed, as a refractory joint material or a glass presser packing material of Type A or B fireproof doors.

[0002]

[Prior Art]

Conventionally, as the refractory foamed joint material for PC boards there have been used silicone rubber foamed bodies or the like, in which chloroprene rubber is foamed and it is combined with ceramic fiber or added with a refractory material. However, the former is troublesome in the work of sticking said joint material to concrete surface, while in the latter there are ones in which silicone rubber is added with platinum catalyst and a refractory material such as mica and crystallite (quartz powder), but with such materials alone the refractoriness is not sufficient. Further, as the refractory fire-retardant seal members of stereo-type gasket for fireproof doors there are chloroprene rubber added with a large quantity of chlorine-based fire retardant, silicone rubber is added with platinum catalyst and a refractory material such as mica or crystallite, and the like. However, the former generates a large quantity of poisonous hydrogen chloride gas at combustion, while with the silicone rubber gasket for fireproof doors in the latter it is impossible to obtain a sufficient strength after combustion, and it cannot be said that the refractory function is sufficient being released.

[0003]

[subject to be solved by the invention]

The object of the invention is to provide a refractory fire

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retardant silicone rubber composition in which it is possible to solve such problems of disadvantages of conventional refractory compositions as complicated workability, insufficient refractoriness, insufficient strength, and generation of poisonous gas at combustion.

[0004]

[Means to Solve the Problems]

That is, the present invention relates to a refractory fire-retardant silicone rubber composition which comprises:

- | | | |
|-----|---|---------------------------|
| (a) | organopolysiloxane shown with the average unit formula $\text{SiO}(4-a)_2$ (wherein R is an unsubstituted or substituted monovalent hydrocarbon radical of same kind or different kind, and <u>a</u> is mean number of 1.9-2.1) | 100 parts by weight |
| (b) | silica powder | 10-100 parts by weight |
| (c) | mica | 50-100 parts by weight |
| (d) | crystallite | 10-50 parts by weight |
| (e) | aluminium hydroxide | 1-80 parts by weight |
| (f) | magnesium hydroxide | 6-80 parts by weight |
| (g) | platinum or platinum compound containing platinum of same quantity relative to (a) in terms of platinum | 5-500ppm |

and in which aluminium hydroxide/magnesium is of the ratio 1/9 to 4/6, and the total quantity thereof is 10 to 80 parts by weight.

[0005]

The invention will now be described hereunder in detail. The invention is to solve the above problems, and (a) is organopolysiloxane shown with an average unit formula $\text{SiO}(4-a)_2$ (wherein a is a mean number of 1.9 to 2.1, and R is alkyl group such as

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methyl group, ethyl group, propyl group, butyl group, pentyl group, hexyl group or heptyl group; an allyl group such as phenyl group or tolyl group; an alkenyl group such as vinyl group or aryl group, or groups which are substituted with organic groups which contain halogen atoms in part or whole of the hydrogen atoms bonded with the carbon atoms of said groups, amino group, cyano group, epoxy group and carboxyl group; unsubstituted or substituted monovalent hydrocarbon groups mutually of same kind or different kinds, preferably the 80 mol percent or more thereof is a methyl group, and 0.1 to 0.5 mol percent is a vinyl group. Preferably, the viscosity of the organopolysiloxane at 25°C is more than 1,000 cSt, and more preferably more than 10,000 cSt. In addition, the end of this organopolysiloxane is blocked by silanol group, methyl group and vinyl group, and it is preferable that in particular said end is blocked by vinyl group.

[0006]

As the (b) components it is possible to use commercially available products such as fume property silica, hydrophobic silica, wet type silica, quartz powder and diatomaceous earth, and its purpose is to increase the strength and quantity of the silicone rubber, but the particle size thereof needs to be uniformly dispersed in (a) organopolysiloxane so that preferably it is not more than 50 micron meters. The additive amount is 10 to 100 parts by weight to 100 parts by weight of (a) organosiloxane. However, with less than 10 parts by weight the reinforcing strength of rubber is insufficient and if exceeds 100 parts by weight the reinforcing effect does not change and reversely the various original properties of rubber are lessened. The mica of (c) component and the crystallite of (d) component are to impart refractoriness and fire retardancy to the composition, the additive quantity of (c) component is needed in

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50 to 100 parts by weight relative to 100 parts by weight of organopolysiloxane, and the additive quantity of (d) component is required in 10 to 50 parts by weight relative to 100 parts by weight of organopolysiloxane. If these additive quantities are respectively less than 50 weight parts and 10 weight parts, ceranictization is impossible at an elevated temperature and refractoriness also becomes insufficient. On the other hand, if exceeds 100 weight parts and 50 weight parts respectively, the composition changes to be of high viscosity. From the viewpoint of dispersability and strength retention it is preferable that the particle size is less than 50 micrometers. On the other hand, for the same reason it is also preferable that the particle size of crystallite is less than 50 micrometers, too.

[0007]

The aluminium hydroxide of (e) component and the magnesium of (f) component each discharges water at an elevated temperature to become aluminium oxide and magnesium oxide, but at that time the combustion temperature is lowered due to the evaporation latent heat of water. The reasoning of using the two kinds in common is that the aluminium hydroxide commences to discharge water at about 180° and finishes the discharging at about 350°C. Further, the magnesium hydroxide starts discharging of water at about 340°C and the discharging continues to about 450°C. Therefore, it is possible that due to the common use of both the components, water is continuously discharged in a wide range of temperatures thereby to control the rise of the combustion temperature, but in order to exhibit sufficient fire retardancy and refractoriness it is necessary that the total quantity of both the components is in the range 10-80 parts by weight. With less than 10 parts by weight of the effect is insufficient, and if exceeds 80 parts by weight the

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formability is deteriorated so as to become hard and fragile thereby causing a problem in practical use. The mixing ratio of the two components in which the continuous water discharging based on the aluminium hydroxide and the magnesium hydroxide is most effectively carried out, and the rise of the combustion temperature can be controlled, is in the range that aluminium hydroxide to magnesium hydroxide is 1/9 to 4/6. Moreover, addition of these components presents a merit of accelerating the ceramictization of what is burned. As these two components the commercially available products are normally usable.

[0008]

The platinum and platinum compound of (g) component acts as a fire retardant of silicone rubber and as a ceramictizing agent under high temperature of silicone rubber together with the added filler. Generally, since silicon rubber has a low cross-linking degree the main chain of siloxane decomposes at an elevated temperature whereby a low molecular cyclic body of evaporating property is quickly produced and its combustion continues. If platinum catalyst exists, it promotes oxidation/deterioration on the surface where it contacts the air of rubber, it produces a high cross-linking structure, and it forms a siloxane film on the surface, which is less organic group and close to non-combustion so as to block air, and therefore the combustion does not extend into the rubber so that the rubber makes self-burning. To supplement the activation of the platinum catalyst, various kinds of auxiliary agents in small quantity may be used. As the (g) component there are exemplified metal platinum like platinum black, platonic chloride, complex salt of platonic chloride with alcohol, ether, acetaldehyde, and the like. However, the metal platinum may be carried by a carrier like alumina or silica gel, and platonic chloride and its complex salt may be

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added as an alcohol solution. The adding amount of platinum is required to add in the range 5-500ppm relative to (a) organopolysiloxane, but preferably in the range 20-500ppm. With the additive amount of less than 5ppm the function proper to the catalyst is not exhibited, but even with more than 500ppm the catalyst effect does not change so that it is not economical to use over 500ppm.

[0009]

The refractory fire-retardant silicone rubber composition according to the present invention can be easily obtained by mixing in a predetermined quantity the components (a) to (g) above. If necessary, they may be added with silane or low molecular siloxane containing alkoxy group, silanol group or the like as a dispersion auxiliary agent in the rubber of (b) silica, but its kind and quantity are selected from the matter of property required in response to the end use of the rubber. Further, in order to enhance the adhesive strength of the matrix of the refractory filler with the organopolysiloxane, it may be treated with a silane coupling agent, etc. Furthermore, as the heat-resistant improving agent and coloring agent it will be all right to add inorganic pigments such as titanium white, titanium yellow, red ochre, chrome green and chrome yellow.

[0010]

In the composition according to the present invention, the silicone rubber becomes excellent in the physical properties due to heating and hardening, but the hardened material controls the decomposition of the silicone rubber by the platinum catalyst even if exposed to a temperature, for example, of 800°C or higher, and it controls generation of combustible gas while simultaneously lowering the combustion temperature by the evaporation latent heat

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emitted by the water discharging from the aluminium hydroxide and magnesium hydroxide. Moreover, by the dilution action of the combustible gas by the generated steam the composition becomes very non-combustible, and by generating fine foams by the volatile water a volume expansion (1.1 to 1.5 times) is caused. In addition, in that the magnesium hydroxide, mica, crystallite and the like are tightly bonded with silicone rubber to become ceramic-like whereby it becomes possible that the glass or the like secured to sash is firmly retained.

[0011]

[Examples]

The invention will now be described more in detail by way of Examples; but the invention is not limited to such embodiments. 100 parts by weight of methylvinyl polysiloxane KE78VBS (brand name of goods made by Shinetsu Chemical Industries Co., Ltd.) containing 0.15 mol% of vinyl group, whose both ends are blocked by vinyl group, was added with 50 parts by weight of wet type silica having 100 m²/g specific surface area, 40 parts by weight of mica (white mica) having mean particle size 13 micrometers, 20 parts by weight of crystallite (quartz powder) having mean particle size 4 micrometers, and platinum catalyst CATPC-2 (brand name of product made by Shinetsu Chemical Industries Co., Ltd.) in 50ppm in terms of platinum relative to the methylvinylpolysiloxane. Said standard mixing ratio was added respectively with aluminium hydroxide (mean particle size being 1 micrometer) and magnesium hydroxide (mean particle size being 0.6 micrometers) while changing the additive quantities respectively, and then they were added with 1.5 parts by weight of monomethylsilane as a cross-linking agent so as to prepare eight kinds of fire retardant compositions as illustrated in Table 1.

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[0012]

The compositions of Examples 1-3 and the comparative examples 1-5 were entered into a heating furnace and the temperature was raised in agreement with the heating temperature curve regulated in JIS A131 so as to be burned.

[0013]

Table 1

Table 1

Table 1

| | Examples | | | | | Comparative Examples | | | | |
|------------------------------------|--|-----|-----|-----|--|----------------------|-----|-----|-----|-----|
| | 1 | 2 | 3 | | | 1 | 2 | 3 | 4 | 5 |
| Composition | Methyl vinyl polycyclohexane | 100 | 100 | 100 | | 100 | 100 | 100 | 100 | 100 |
| | Cross linking agent | 1.5 | 1.5 | 1.5 | | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| | Wet process silica | 80 | 50 | 50 | | 50 | 50 | 50 | 50 | 50 |
| | Mica | 40 | 40 | 40 | | 40 | 40 | 40 | 40 | 40 |
| | Orisaltite | 20 | 20 | 20 | | 20 | 20 | 20 | 20 | 20 |
| | Platinum catalyst (ppm) | 50 | 50 | 50 | | 50 | 50 | 50 | 50 | 50 |
| Property of matter of entered body | Aluminium hydroxide | 5 | 15 | 20 | | 0 | 0 | 50 | 80 | 80 |
| | Magnesium hydroxide | 45 | 35 | 30 | | 0 | 50 | 0 | 0 | 80 |
| | Hardness (JIS A) | 75 | 75 | 75 | | 60 | 75 | 75 | 85 | 85 |
| | Tension strength (kg/cm ²) | 65 | 64 | 82 | | 72 | 62 | 63 | 40 | 38 |
| | Elongation | 230 | 223 | 210 | | 255 | 225 | 224 | 90 | 92 |
| | Oxygen Index | 70 | 80 | 75 | | 35 | 65 | 65 | 68 | 90 |
| | Hardness | ○ | ◎ | ○ | | × | △ | △ | ◎ | ◎ |
| | Shape retainability | ○ | ◎ | ○ | | × | △ | △ | × | × |
| | Volume increase rate (%) | 125 | 135 | 140 | | 105 | 110 | 110 | 105 | 110 |

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[0014]

With regard to the sintered bodies thus obtained, the hardness, extension strength, elongation, volume increase rate and the oxygen index (JIS K7201) were measured. Further, the hardness and the shape retainability thereof were evaluated in the following standards so as to be shown in Table 1.

Hardness of the sintered bodies @ : Hard and sounds metallic if stricken

O : Comparatively hard, and sounds metallic if stricken

Δ : Comparative hard, but does not sound metallic

X : Not hard and fragile

Shape retainability

Ⓒ : Comparative strong and does not collapse even if gripped

O : Collapses if slightly gripped

Δ : Fragile more than above

X : Fragile

[0015]

From the above Examples it was confirmed that the refractory fire-retardant silicone rubber composition according to the invention is usefully fire-resistant because of hard combustion and sufficient shape retainability of the sintered body.

[0016]

[Effect of the Invention]

The refractory fire-retardant silicone rubber composition according to the invention is provided with simple workability, sufficient refractoriness and sufficient strength as the refractory joint material or glass presser packing material for fire-resistant doors, and it does not generate poisonous gas so as to be safe, and therefore it can solve the problems of known products.

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ABSTRACT

[Object]

To obtain a refractory fire-retardant silicone rubber composition which has simple workability, and sufficient refactoriness and strength and which does not generate posinous gas at combustion.

[Constitution]

A refractory fire-retardant silicone rubber composition comprising organopolysiloxane shown with the average unit formula $\text{R}_a\text{SiO}(4-a)/2$, silica powder, mica, crystallite, aluminium hydroxide, magnesium hydroxide, and platinum or platinum compound containing platinum in the same quantity.